INTERNATIONAL SYMPOSIUM AND WORKSHOP ON ASTROCHEMISTRY

Understanding extraterrestrial molecular complexity through experiments and observations

Experimental Workshop on Astrochemistry

Ionization Sources and Detectors for Spacial Environments Simulation Experiments

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PUC-RIO

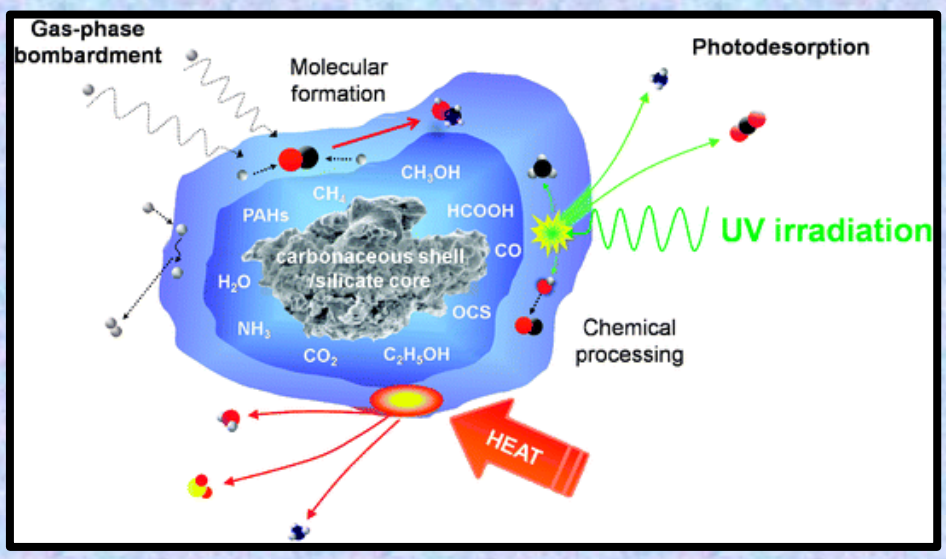
05/07/2016

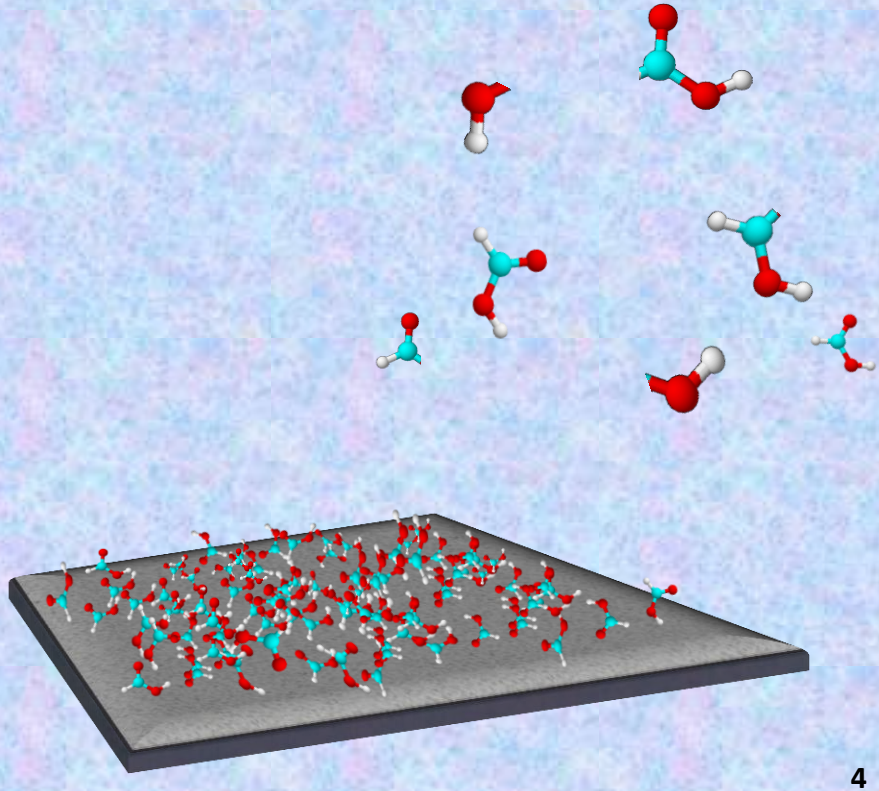
Interestelar Medium Simulation

- ***O conhecimento dos processos de dissociação molecular, excitação e de dessorção de espécies induzidos por radiólise são de extrema importância para a compreensão da química no MI.***

- ***A ocorrência de tais processos nos mantos de gelo astrofísico que recobrem os grãos de poeira interestelar podem levar à formação de moléculas orgânicas mais complexas.***

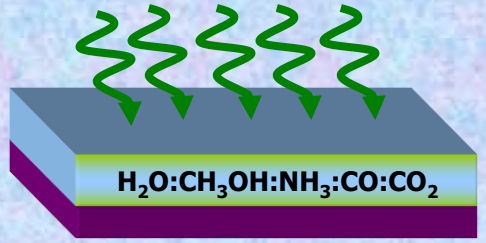
- ***A quantificação dos fragmentos gerados nestes processos é importante para a atualização e aperfeiçoamento dos modelos astroquímicos vigentes.***





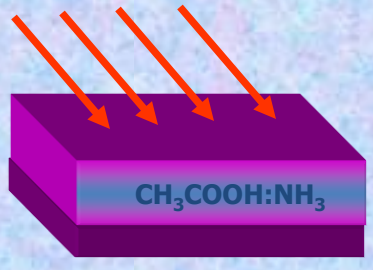
Typical Projectiles Used :

- **Photons (6 to 2000 eV) [CHOMPS Region]**
  (UV and Soft X-Rays)
  (Excitation of Valence Shells and Inner Shells)



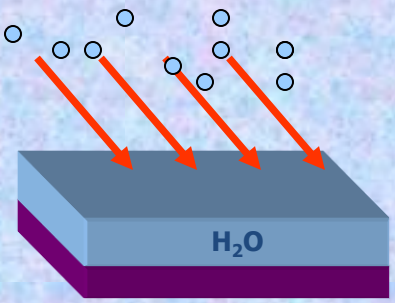
Muñoz Caro *et al.*, Nature **416** (2002) 403

- **Electrons (low and high energy range)**
  Low Energy – DEA
  High Energy – Dissociation by Ionization and Scattering



Lafosse *et al.*, PCCP **8** (2006) 5564

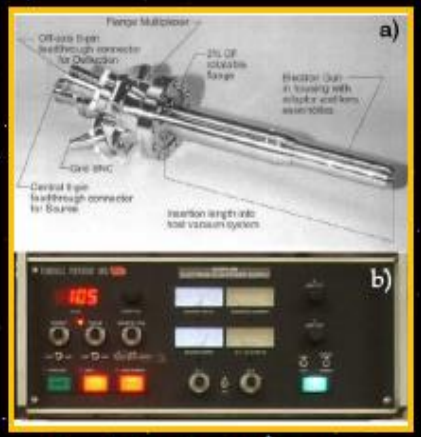
- **Ions**
  Simulate Solar Wind Effects – KeV region
  Simulate Cosmic Ray Effects – MeV Region



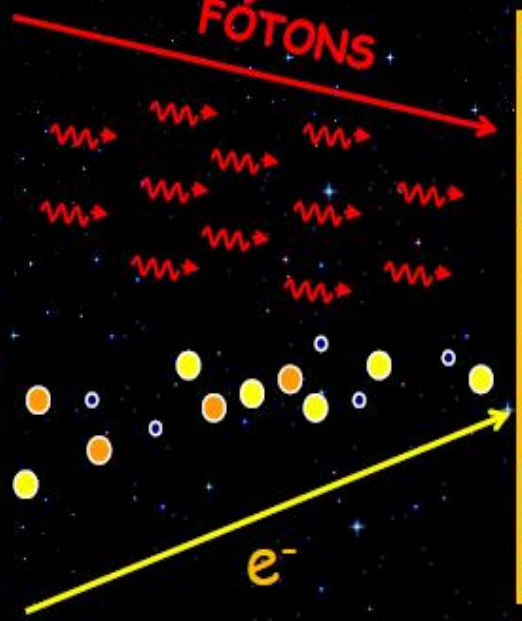
Strazzulla & Baratta, Europhysics Letter 18 (1992) 517

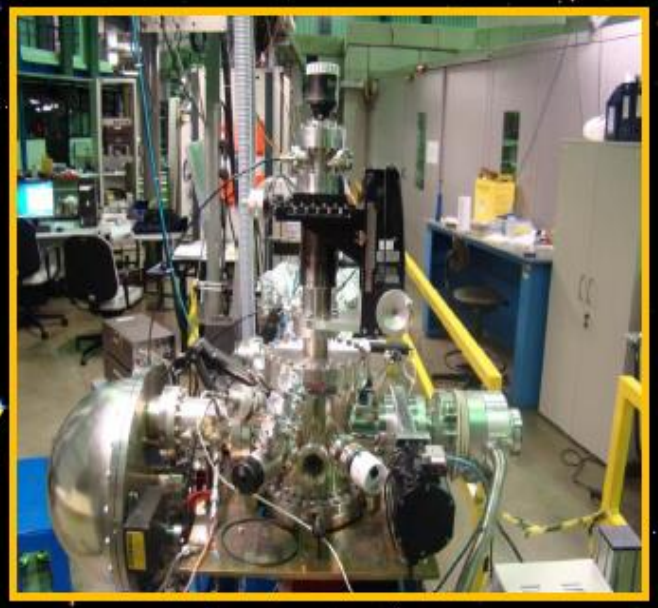
Simulação do MI em Laboratório

Radiação Síncrotron



Canhão de Elétrons

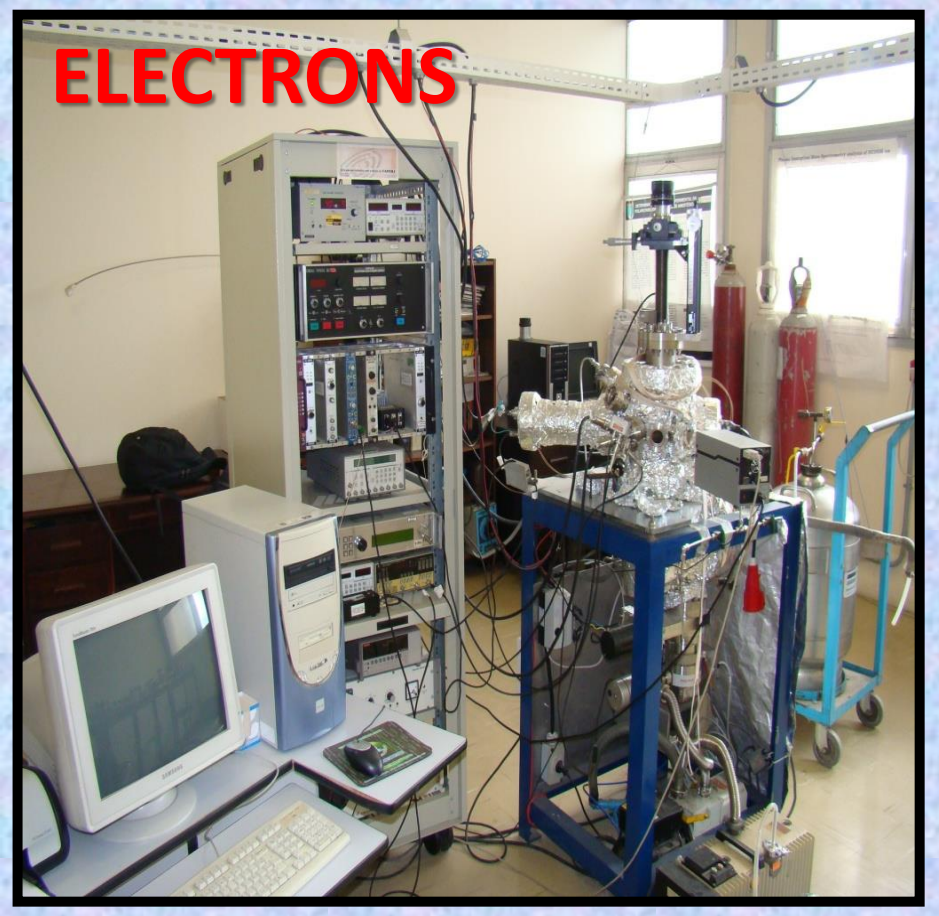




Câmara de Ultra-alto Vácuo

As estrelas são substituídas por radiação síncrotron, fontes radioativas geradoras de íons energéticos e feixes de elétrons.

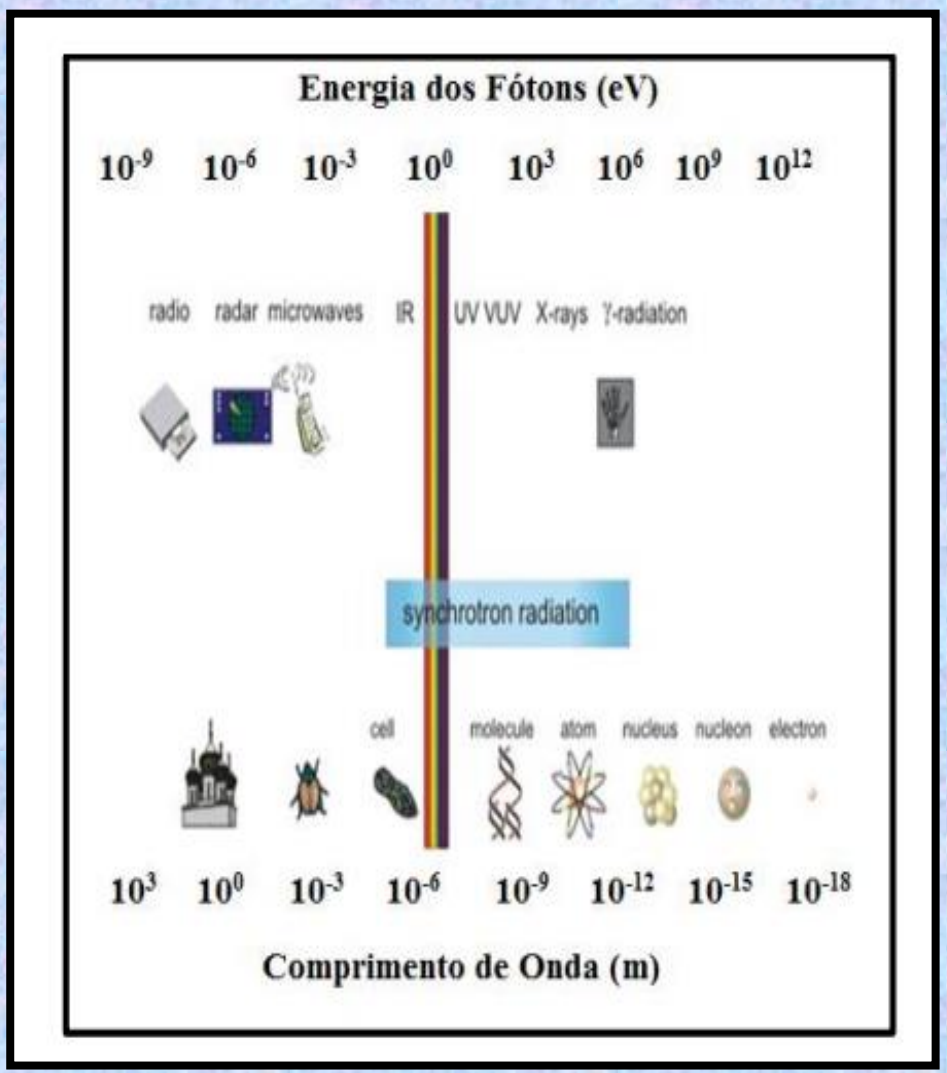
Instalações Utilizadas (Facilities Used)

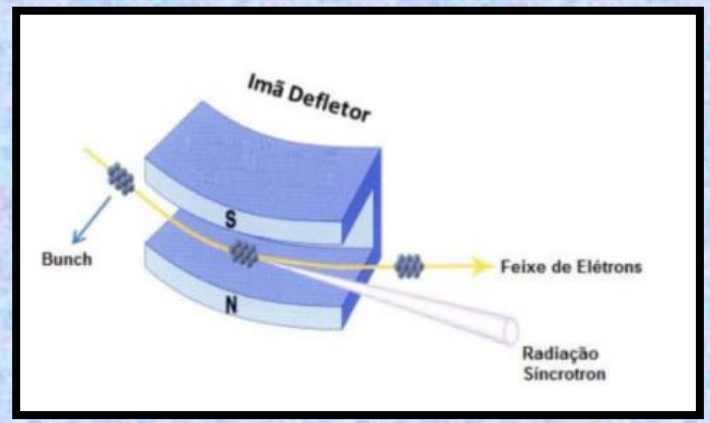


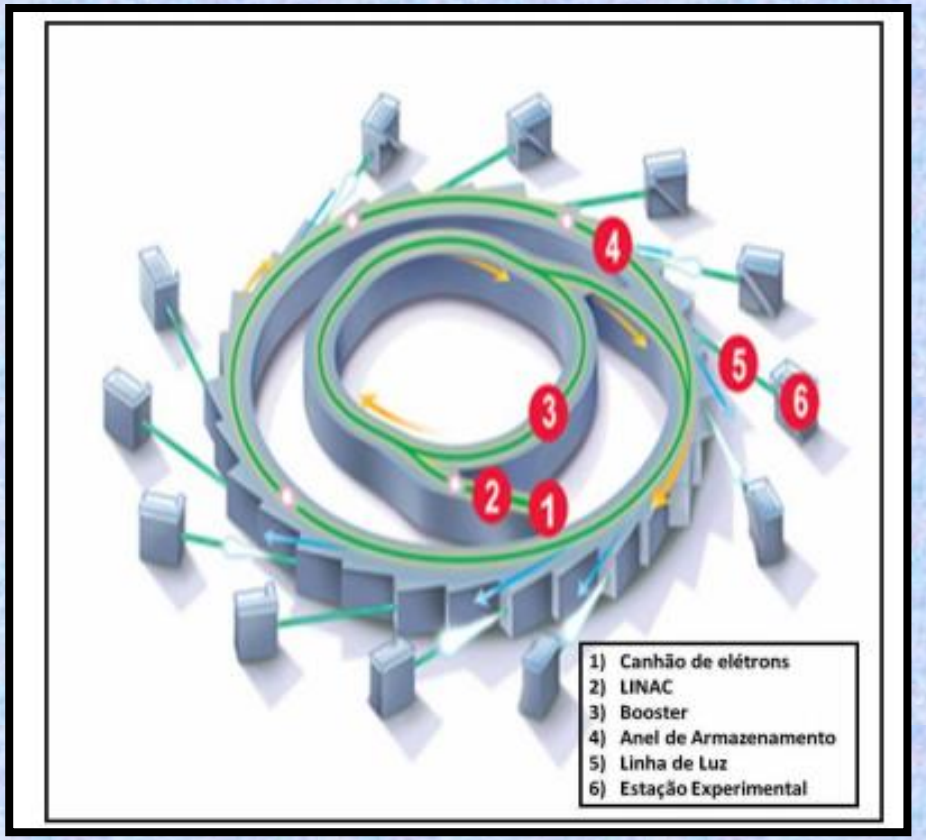
Laboratório de Química de Superfícies
(LAQUIS)
Rio de Janeiro, RJ
IQ-UFRJ
Experimentos de ESID

Laboratório Nacional de Luz Síncrotron
(LNLS)
Campinas, SP
Linha SGM (Raios X Moles)
(250-1000 eV)
Experimentos de PSID e de Fotoestabilidade

A Radiação Síncrotron (Synchrotron Radiation)

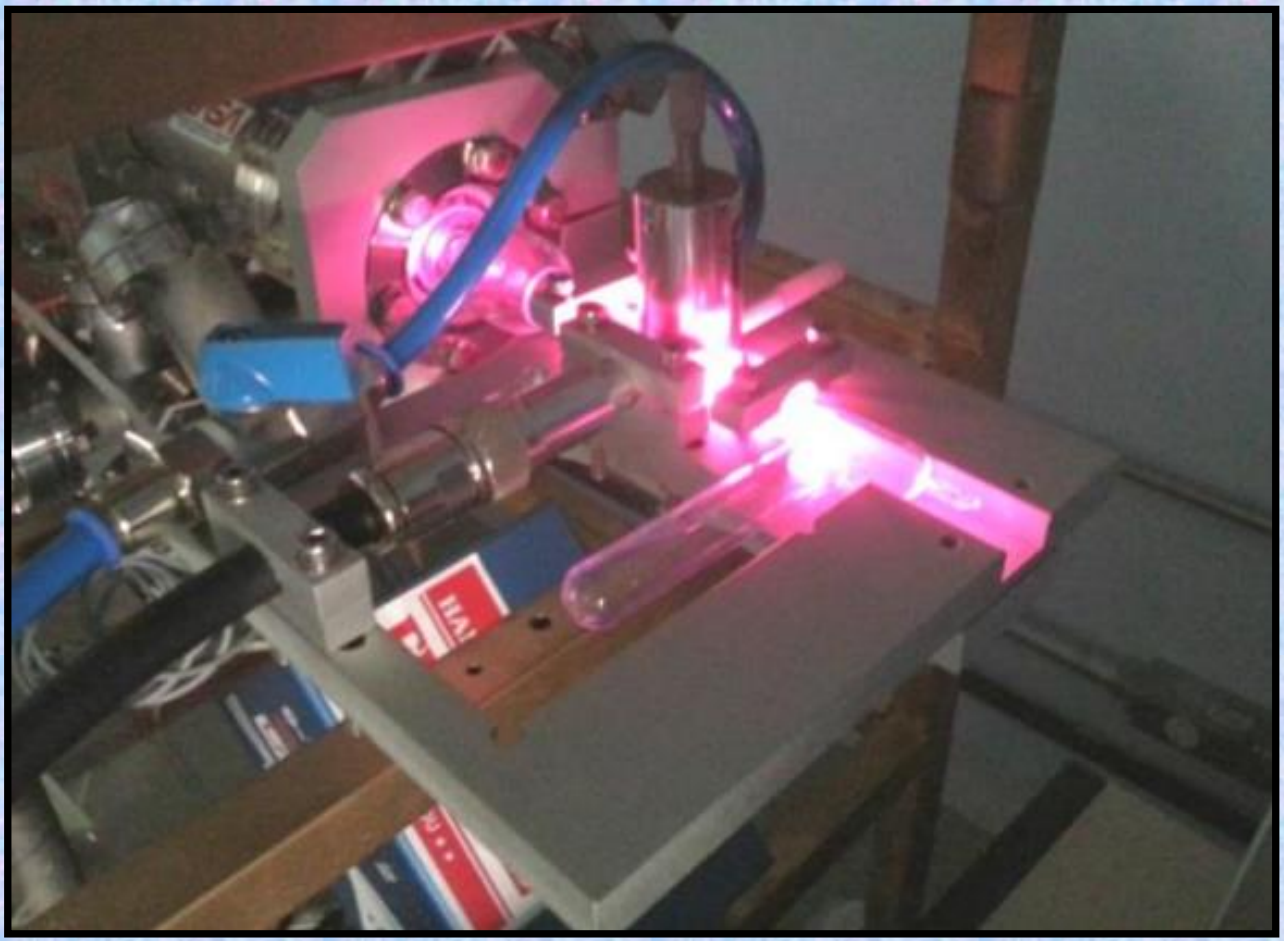






For UV and X-Ray Photons

- **You Can also Use: Discharge Lamps**
- **But, Synchrotron Light is a Tunable Source!!!**



UV Lamp – Sergio Pilling's Lab
LASA - UNIVAP

Lower Energy Ions

He Ion Source

UNIVERSITÉ DE RENNES 1

France

Microwave Discharge Devices

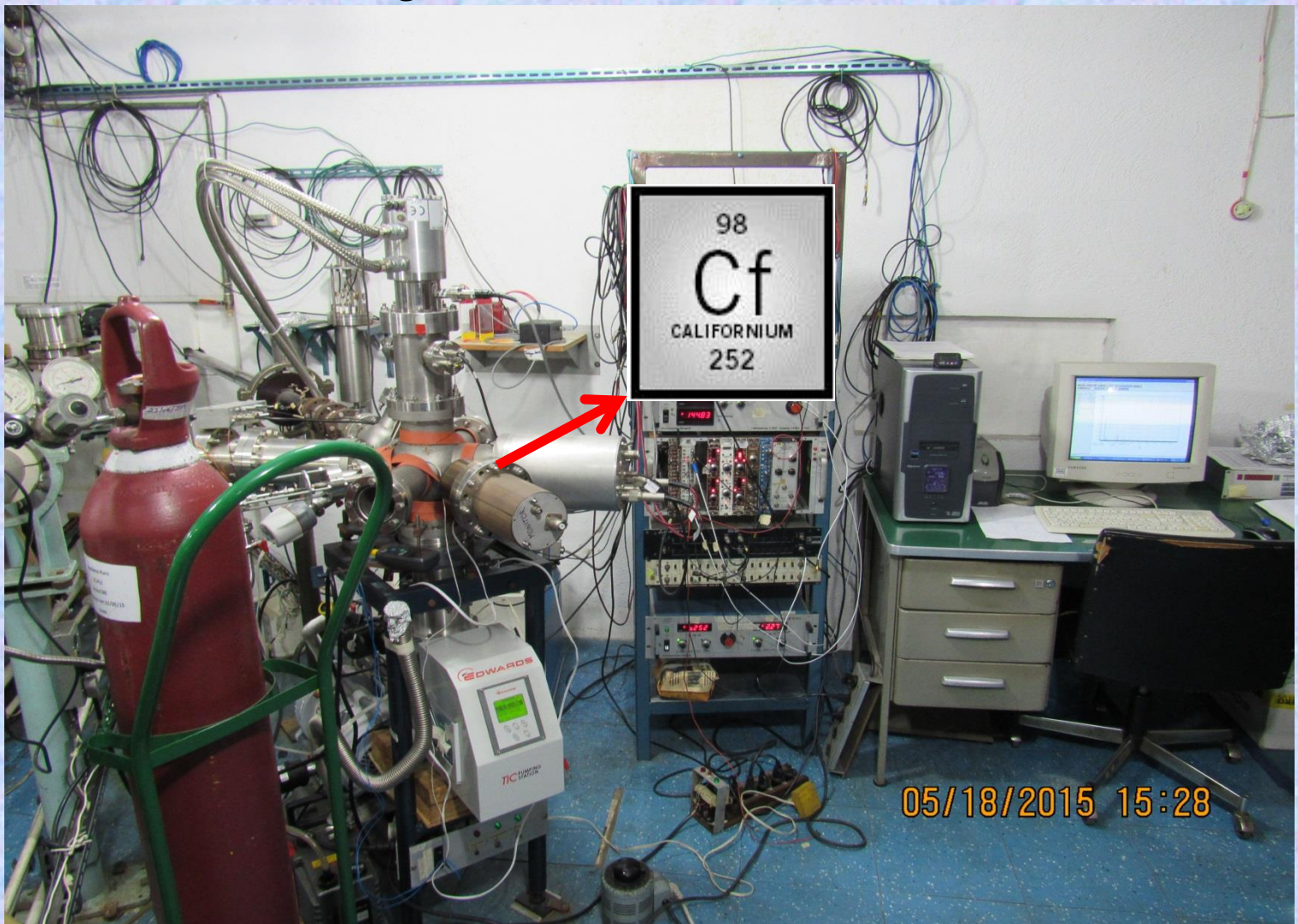
High Energy Ions
Van de Graaff Accelerator

Van de Graaff Laboratory (VDG)
PUC-Rio

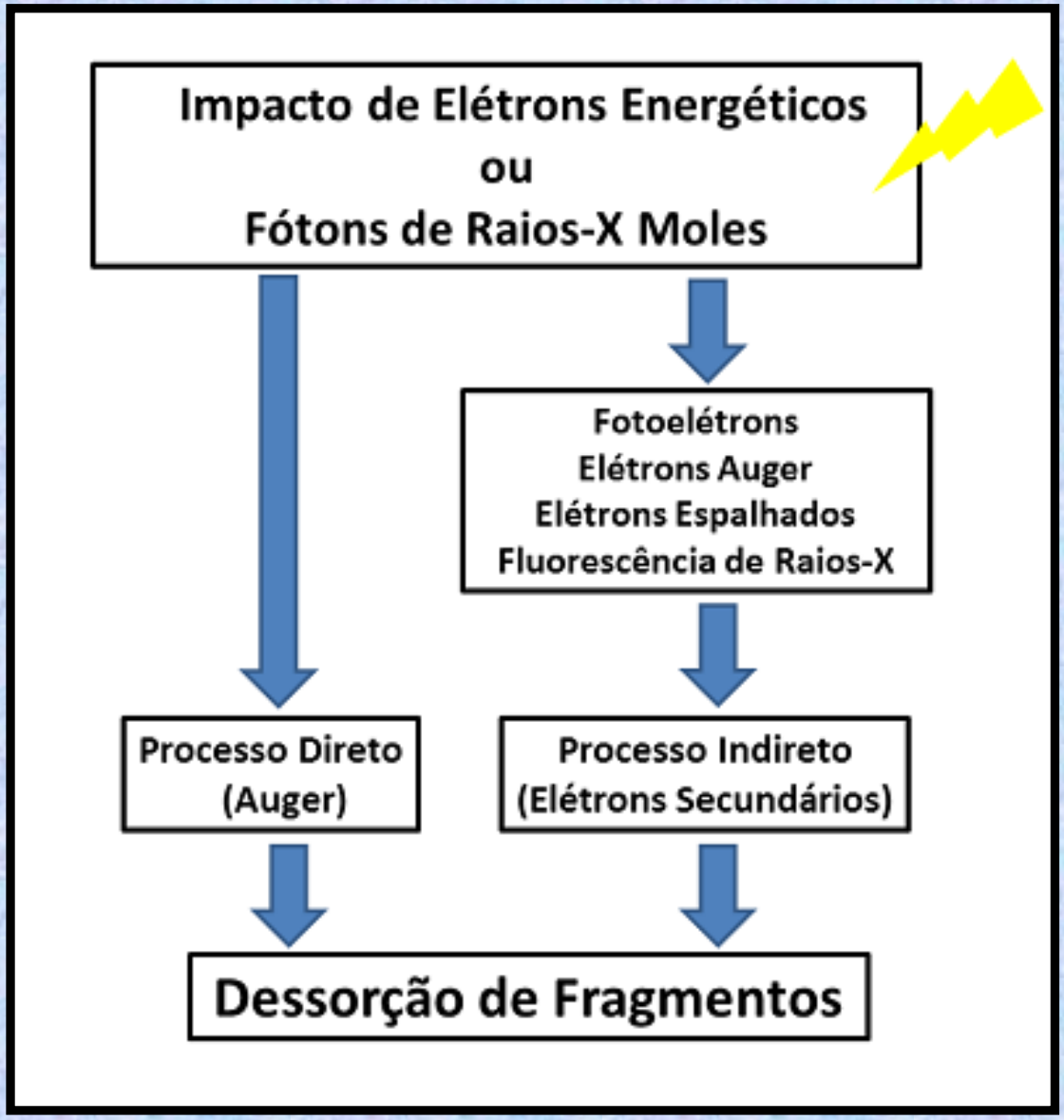
OTHER ION SOURCES

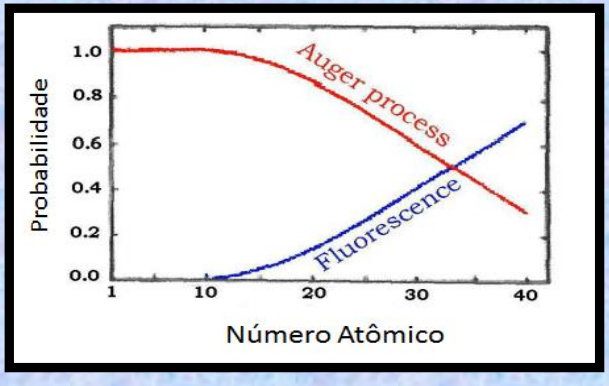
Simulação de Raios Cósmicos: Câmara PDMS Criogênica

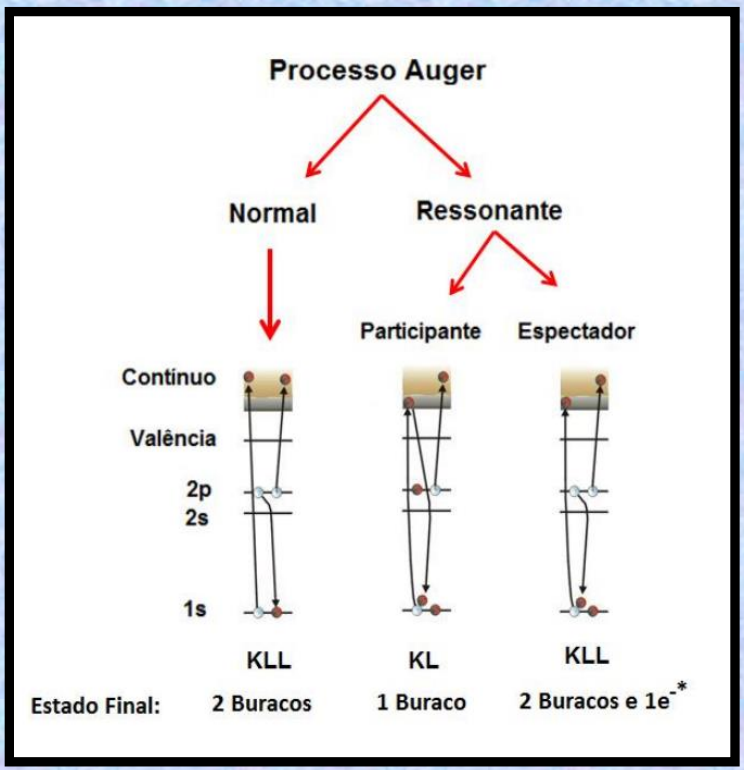
Energia dos FF's : 65 MeV – Strong α emission



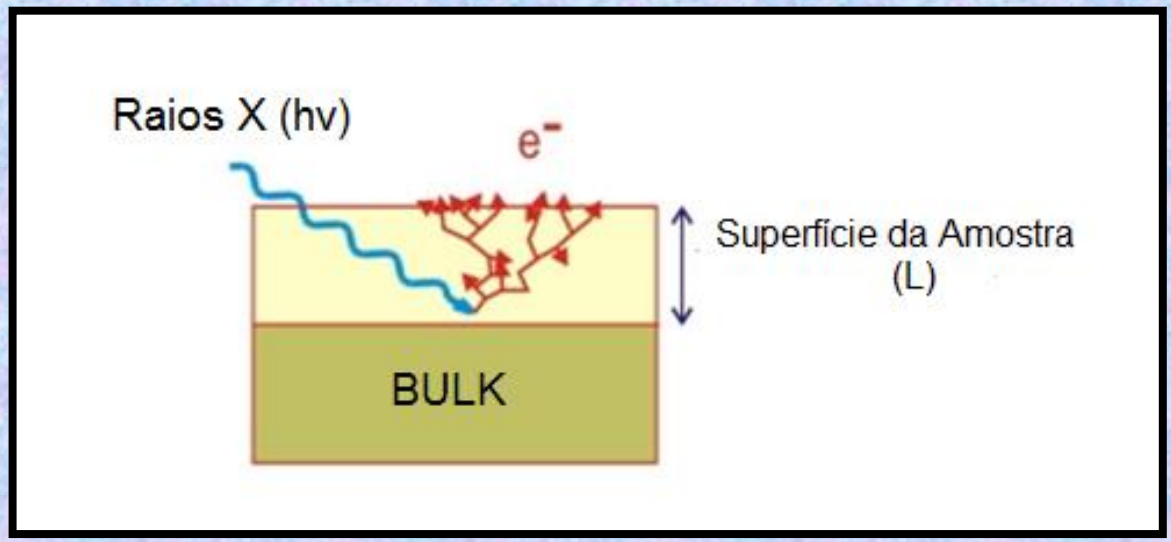
Physical Chemical Processes



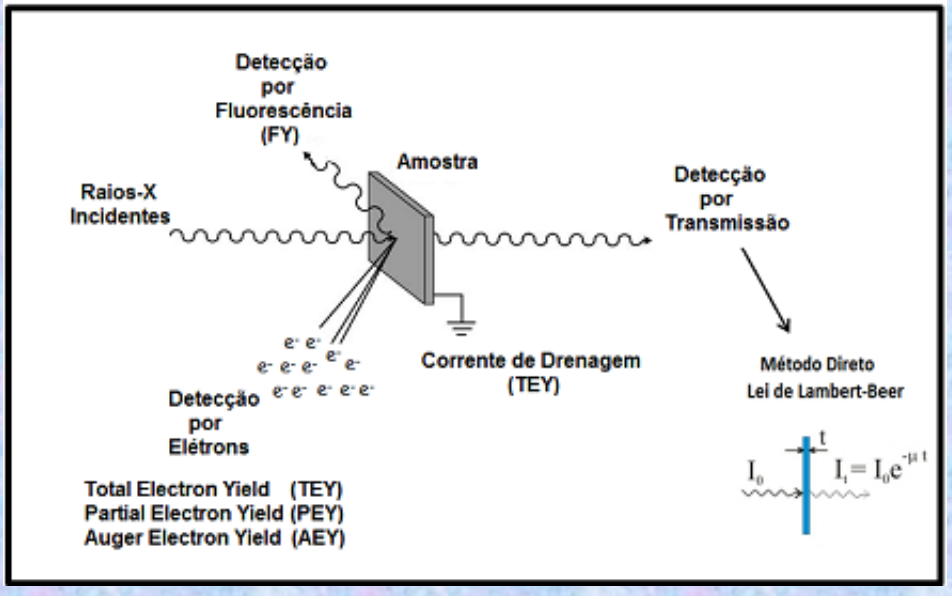




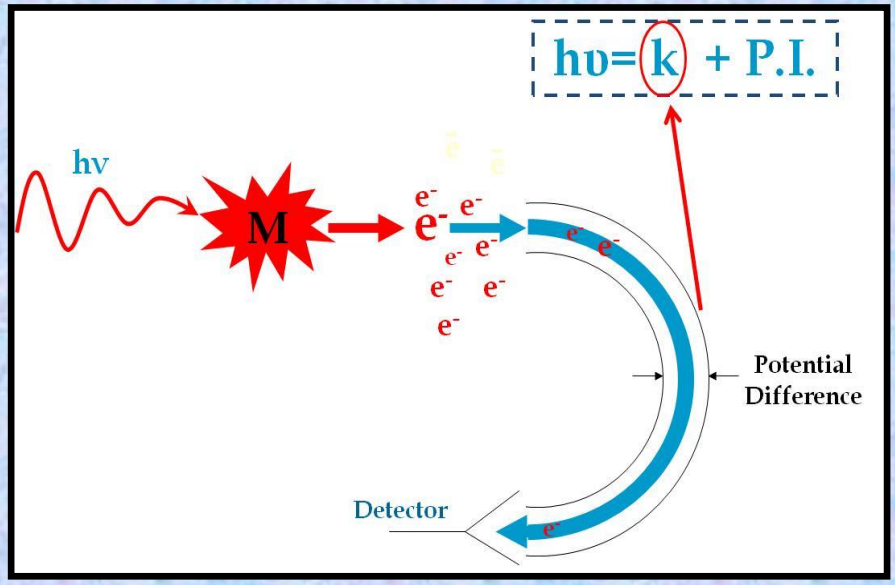
Secondary Electrons



METODOLOGIA DE DETECÇÃO



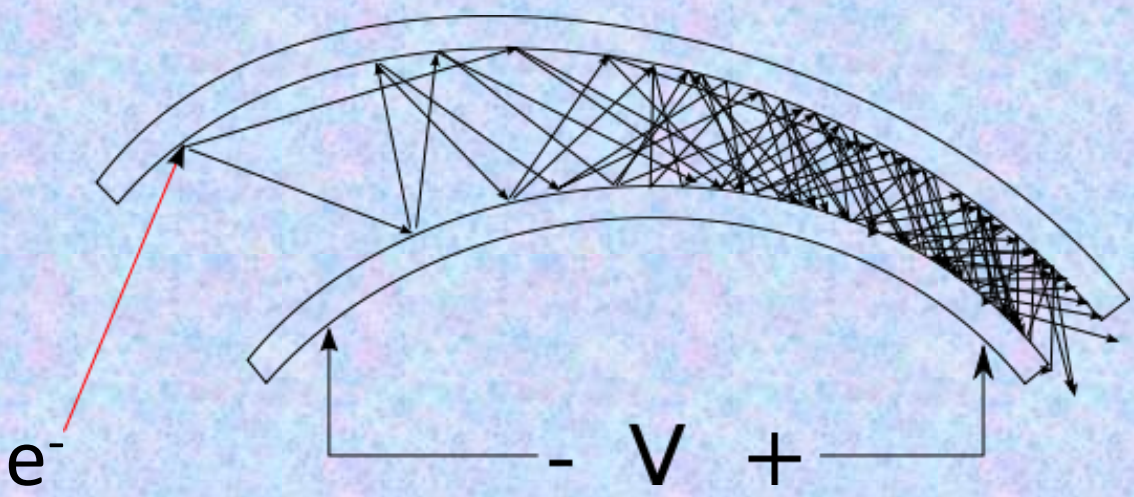
ANALISADOR HEMISFÉRICO DE e^-



Detectors

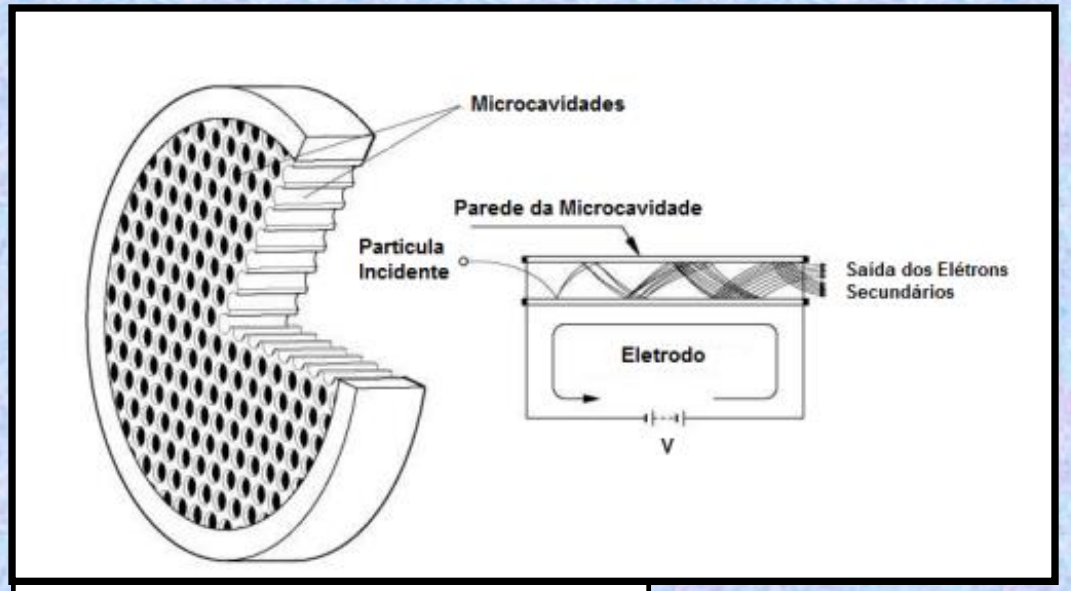
Channeltron

- **Detector Based on Secondary Emission**



Detectors

Microchannel Plate – (MCP)



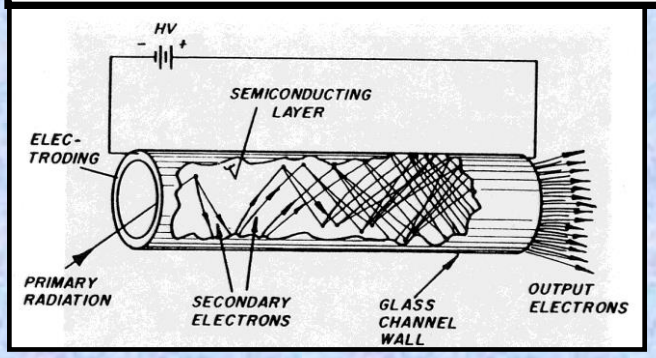
Vidro Chumbo: SiO_2+ Pb_2O_3

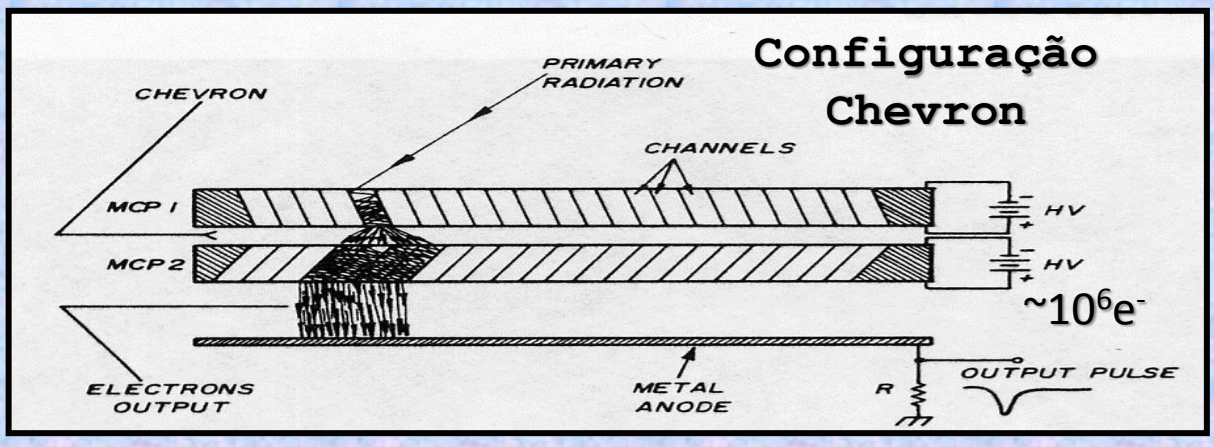
10^4-10^7 canais

ø = 10-100μm

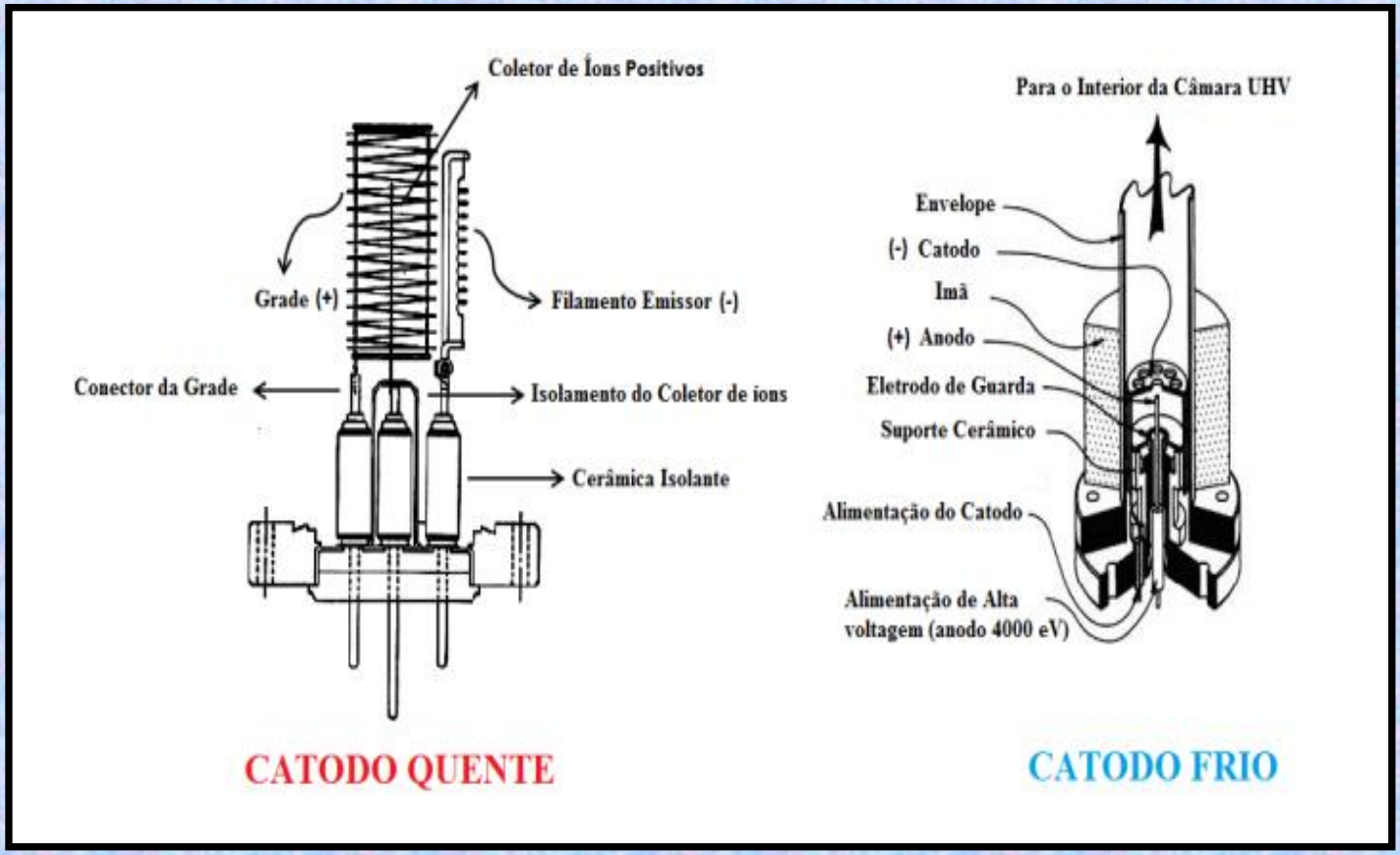
t_{res}= *100ps*

Detects : Electrons , Ionizing Photons and Ions



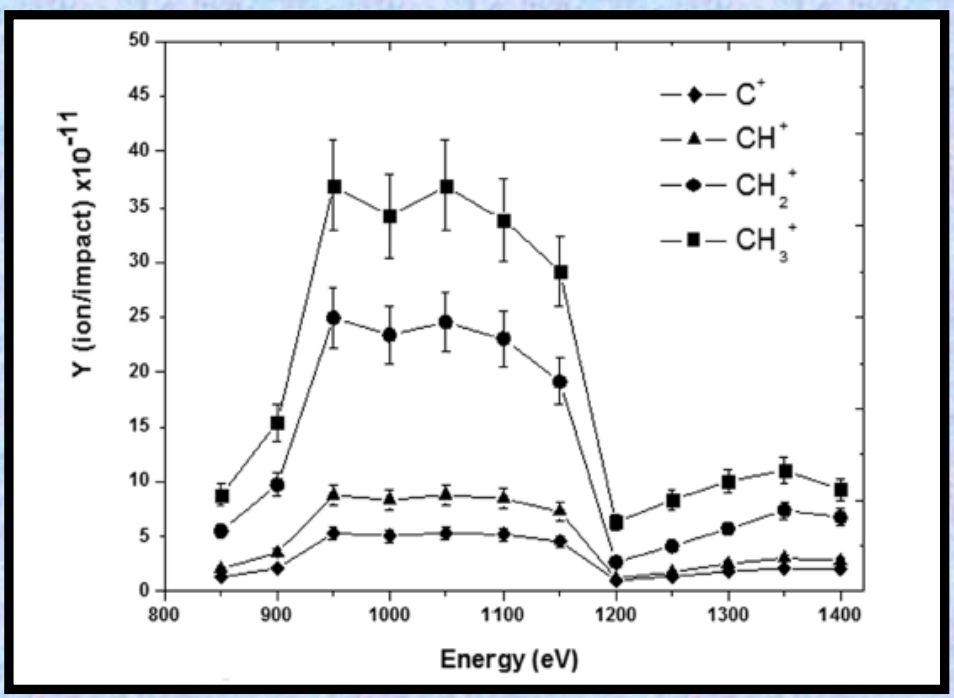


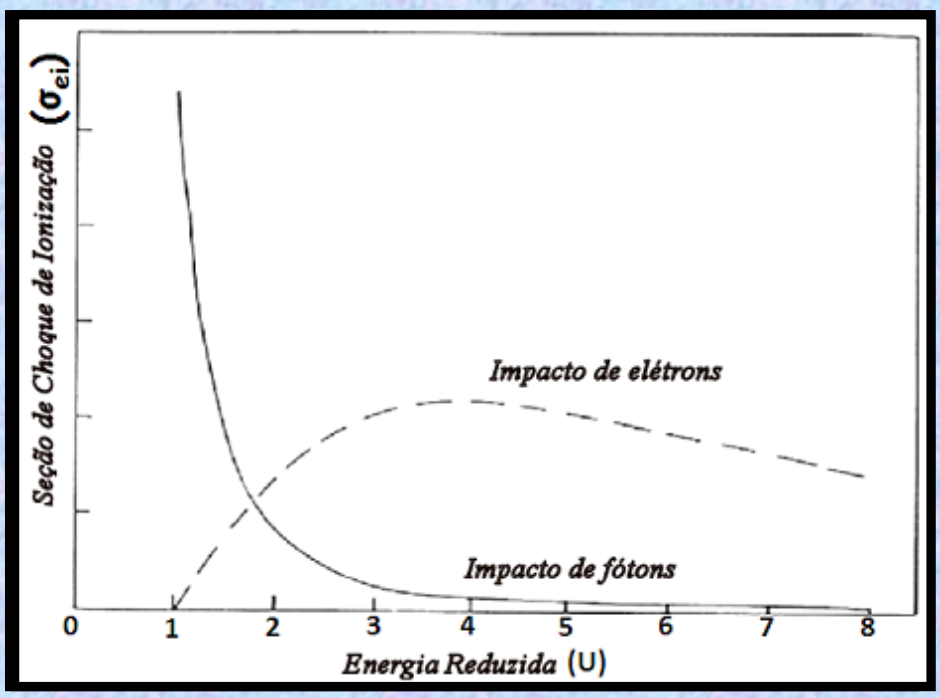
Pressure Detectors



Rendimento Iônico (Ionic Yield)

$$Y_{e^-} = \frac{A_{ip}}{N_p^0 \,.\, N^0_{\frac{e^-}{p}}}$$





Curvas de Rendimento iônico (800-1400 eV)

$U=E/E_b$

Almeida, G.C. et al. J. Phys. Chem. C, 2012, 116, 25388−25394.

Questions? Comments?

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